CLAIMS

1. A near-infrared ray absorption film, characterized in that a near-infrared ray absorption layer comprising a composition containing a near-infrared ray absorbing dye having a maximum absorption in a range of 800 nm in wavelength to 1,200 nm in wavelength, and further containing a resin is provided on a transparent substrate film, wherein a surfactant having an HLB in a range of 2 to 12 is contained at 0.01% to 2.0% by mass in the composition.

2. The near-infrared ray absorption film according to claim 1, wherein the surfactant is a silicone type surfactant or a fluorine type surfactant.

3. The near-infrared ray absorption film according to claim 1, wherein the near-infrared ray absorption layer further contains a color correcting dye having a maximum absorption in a range of 550 nm in wavelength to 620 nm in wavelength.

4. The near-infrared ray absorption film according to claim 1, wherein the near-infrared ray absorbing dye comprises an aromatic diimmonium salt

type compound.

5. The near-infrared ray absorption film according to claim 1, wherein the transparent substrate film comprises a laminated film made of at least three layers or more, and a layer having an ultraviolet absorbing agent is provided at an intermediate part other than a surface layer.

6. The near-infrared ray absorption film according to claim 1, wherein the near-infrared ray absorption layer is formed on the transparent substrate film with an adhesion modifying layer being interposed, the adhesion modifying layer containing, as a main component, an adhesion modifying resin having an acid value of 200 eq./t or more.

7. The near-infrared ray absorption film according to claim 6, wherein the adhesion modifying resin is a polyester type graft copolymer in which a polyester type resin is grafted with an acid anhydride having at least one double bond.

8. The near-infrared ray absorption film according to claim 1, wherein it has a light

transmittance of not lower than 55% in a range of 450 nm in wavelength to 650 nm in wavelength, and a light transmittance of not higher than 20% in a range of 820 nm in wavelength to 1,100 nm in wavelength.

9. The near-infrared ray absorption film according to claim 3, wherein it has a light transmittance of 10% to 60% in a range of 550 nm in wavelength to 600 nm in wavelength, and a light transmittance of not higher than 20% in a range of 820 nm in wavelength to 1,100 nm in wavelength.

10. The near-infrared ray absorption film according to claim 1, wherein an anti-reflective layer is provide on a side opposite to the near-infrared ray absorption layer provided on the transparent substrate film.

11. A near-infrared ray absorption film roll, characterized in that it comprises a near-infrared ray absorption film according to claim 1 wound up at a length of 100 m or greater and a width of 0.5 m or greater, wherein a long film wound up in this roll has a maximum of a color difference Δ(MD) measured by a following measuring method (A) of 2.0 or smaller:

(A) in a measurement of a color tone of the film, in a longitudinal direction (MD) of the film, letting one end of a steady region where film physical properties are stabilized to be a first end, and letting the other end to be a second end, first measurement is carried out within 2 m on an inner side of the first end, and final measurement is carried out within 2 m on an inner side of the second end and, at the same time, measurement is carried out every about 10 m from the first measurement part, and a color difference ΔE(MD) defined by a following equation is calculated at each measurement part:

$$\Delta E(MD) = [(L_a-L_m)^2 + (a_a-a_m)^2 + (b_a-b_m)^2]^{1/2}$$

wherein L_m, a_m, and b_m mean color tones L, a, and b at each measurement part, respectively, and L_a, a_a, and b_a mean averages of color tones L, a, and b, respectively, at all measurement parts.

12. A near-infrared ray absorption film roll, characterized in that it comprises a near-infrared ray absorption film according to claim 1 wound up at a length of 100 m or greater and a width of 0.5 m or greater, wherein a long film wound up in this roll has a maximum

of a color difference Δ(TD) measured by a following measuring method (B) of 1.0 or smaller:

(B) in a measurement of a color tone of the film, in a width direction (TD) of the film, letting one end of a steady region where film physical properties are stabilized to be a first end, and letting the other end to be a second end, first measurement is carried out within 0.1 m on an inner side of the first end, and final measurement is carried out within 0.1 m on an inner side of the second end and, at the same time, measurement is carried out at three parts at an approximately equal intervals between the first measurement part and the final measurement part, and a color difference ΔE(TD) defined by a following equation is calculated at these five measurement parts:

$$\Delta E(TD) = [(L_a - L_m)^2 + (a_a - a_m)^2 + (b_a - b_m)^2]^{1/2}$$

wherein L_m, a_m, and b_m mean color tones L, a, and b at each measurement part, respectively, and L_a, a_a, and b_a mean averages of color tones L, a, and b, respectively, at all measurement parts.

13. A process for preparing a near-infrared ray absorption film, characterized in that it comprises

applying a coating solution containing a near-infrared ray absorbing dye, a resin, a surfactant, and an organic solvent on a transparent substrate film, followed by drying, to form a near-infrared ray absorption layer, wherein a surfactant having an HLB in a range of 2 to 12 is used as the surfactant, and this surfactant is contained at 0.01% to 2.0% by mass, relative to a solid content of the coating solution.

14. The process for preparing a near-infrared ray absorption film according to claim 13, wherein in a drying step after application of the coating solution, a step of drying with hot air is divided into multi-stage of 2 or more stages and, in a first stage drying step, drying is carried out at 20°C to 80°C for not shorter than 10 seconds and not longer than 120 seconds and, at a second or later drying step where a drying temperature is highest, drying is carried out at 80°C to 180°C for not shorter than 5 seconds and not longer than 60 minutes.

15. The process for preparing a near-infrared ray absorption film according to claim 13, wherein a reverse gravure method is used as a method of applying the coating solution.

16. The process for preparing a near-infrared ray absorption film according to claim 15, wherein a diameter of a gravure is 80 mm or smaller in the reverse gravure method.

17. A process for preparing a near-infrared ray absorption roll, characterized in that it comprises continuously coating a coating solution containing a near-infrared ray absorbing dye, a resin, a surfactant, and an organic solvent on a transparent substrate film, followed by drying, to prepare a near-infrared ray absorption film provided with a near-infrared ray absorption layer, and winding up the film at a length of 100 m or greater, and a width of 0.5 m or greater,

wherein a surfactant having an HLB in a range of 2 to 12 is used as the surfactant, and this surfactant is contained at 0.01% to 2.0% by mass, relative to a solid content of the coating solution, and

a maximum of a color difference Δ(MD) measured by a following measuring method (A) is controlled at 2.0 or smaller by, after application of the coating solution and drying, measuring a color tone and/or a light transmittance at a specific wavelength by on-line, and adjusting application conditions and/or drying conditions of the coating solution depending on

measurement results:

(A) in a measurement of a color tone of the film, in a longitudinal direction (MD) of the film, letting one end of a steady region where film physical properties are stabilized to be a first end, and letting the other end to be a second end, first measurement is carried out within 2 m on an inner side of the first end, and final measurement is carried out within 2 m on an inner side of the second end and, at the same time, measurement is carried out every about 10 m from the first measurement part, and a color difference $\Delta E(MD)$ defined by a following equation is calculated at each measurement part:

$$\Delta E(MD) = [(L_a-L_m)^2 + (a_a-a_m)^2 + (b_a-b_m)^2]^{1/2}$$

wherein L_m, a_m, and b_m mean color tones L, a, and b at each measurement part, respectively, and L_a, a_a, and b_a mean averages of color tones L, a, and b, respectively, at all measurement parts.

18. The process for preparing a near-infrared ray absorption film roll according to claim 17, wherein application of the coating solution is carried out with a gravure coating apparatus having a gravure roll, and

a rate ratio G/F of a rotation rate G (m/min) of a gravure roll to a running rate F (m/min) of a film is 0.8 to 1.5.

19. The process for preparing a near-infrared ray absorption film roll according to claim 18, wherein as the gravure coating apparatus, an apparatus having a mechanism of scraping up a coating solution from a liquid supplying pan with a reversely rotating gravure roll and scraping down an excess coating solution with a doctor blade, in which at least a part of the doctor blade coming in contact with the gravure roll is made of a ceramic or nickel, is used.

20. A process for preparing a near-infrared ray absorption roll, characterized in that it comprises continuously coating a coating solution containing a near-infrared ray absorbing dye, a resin, a surfactant, and an organic solvent on a transparent substrate film, followed by drying, to prepare a near-infrared ray absorption film provided with a near-infrared ray absorption layer, and winding up the film at a length of 100 m or greater, and a width of 0.5 m or greater,

wherein a surfactant having an HLB in a range of 2 to 12 is used as the surfactant, and this surfactant

is contained at 0.01% to 2.0% by mass, relative to a solid content of the coating solution, and

a maximum of a color difference Δ(TD) measured by a following measuring method (B) is controlled at 1.0 or smaller by applying the coating solution by a kiss coating method, and setting a tension in a longitudinal direction at an applying part of a transparent substrate film to be not smaller than 0.5 N/mm^2 and not greater than 1.2 N/mm^2:

(B) in a measurement of a color tone of the film, in a width direction (TD) of the film, letting one end of a steady region where film physical properties are stabilized to be a first end, and letting the other end to be a second end, first measurement is carried out within 0.1 m on an inner side of the first end, and final measurement is carried out within 0.1 m on an inner side of the second end and, at the same time, measurement is carried out at three parts at an approximately equal intervals between the first measurement part and the final measurement part, and a color difference ΔE(TD) defined by a following equation is calculated at these five measurement parts:

$$\Delta E(TD)=[(L_a-L_m)^2+(a_a-a_m)^2+(b_a-b_m)^2]^{1/2}$$

wherein L_m, a_m, and b_m mean color tones L, a, and b at each measurement part, respectively, and L_a, a_a, and b_a mean averages of color tones L, a, and b, respectively, at all measurement parts.

21. The process for preparing a near-infrared ray absorption film roll according to claim 20, wherein application of the coating solution is carried out with a gravure coating apparatus having a gravure roll, and a rate ratio G/F of a rotation rate G (m/min) of the gravure roll to a running rate F (m/min) of a film is 0.8 to 1.5.

22. The process for preparing a near-infrared ray absorption film roll according to claim 21, wherein as the gravure coating apparatus, an apparatus having a mechanism of scraping up a coating solution from a liquid supplying pan with a reversely rotating gravure roll and scraping down an excess coating solution with a doctor blade, in which at least a part of the doctor blade coming in contact with the gravure roll is made of a ceramic or nickel, is used.

23. The process for preparing a near-infrared ray absorption film roll according to claim 21, wherein

in a drying step after application of the coating solution, a step of drying with hot air is divided into multi-stage of 2 or more stages and, in a first stage of drying step, drying is carried out at 20°C to 80°C for not shorter than 10 seconds, and not longer than 120 seconds and, at a second or later drying step where a drying temperature is highest, drying is carried out at 80°C to 180°C for not shorter than 5 seconds and not longer than 60 minutes and, further, after the multi-stage hot air drying step, a cooling step of cooling with air at a glass transition temperature of a resin constituting the near-infrared ray absorption layer or lower is carried out.

24. A near-infrared ray absorption filter mounted on a front of a plasma display, characterized in that this near-infrared ray absorption filter uses a near-infrared ray absorption film according to claim 10, and the anti-reflective layer of the near-infrared ray absorption film is disposed on a surface side, and the near-infrared ray absorption layer is disposed on the display side.